APPENDIX E

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA) VALUES ASSESSMENT FOR OPERABLE UNIT 2

CONTENTS

FIGURES

ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CAA	Clean Air Act
Cal-EPA	State of California, Environmental Protection Agency
CalTech	California Institute of Technology
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CCl_4	carbon tetrachloride
DCE	1,1-dichloroethene
DOJ	Department of Justice
DTSC	Department of Toxic Substances Control
FFA	Federal Facilities Agreement
Freon 113	1,1,2-trichloro-1,2,2-trifluoroethane
FS	Feasibility Study
FWEC	Foster Wheeler Environmental Corporation
HHRA	human health risk assessment
JPL	Jet Propulsion Laboratory
MCL	maximum contaminant level
NA	no action
NAAQS	National Primary and Secondary Ambient Air Quality Standard
NASA	National Aeronautics and Space Administration
NAVFAC	Naval Facilities Engineering Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act of 1969
NPL	National Priorities List
OU	operable unit
PTO	permit to operate
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision

RWQCB	Regional Water Quality Control Board
SCAQMD	South Coast Air Quality Management District
SIP	State Implementation Plan
SVE	soil vapor extraction
SWRCB	State Water Resources Control Board
TCE	trichloroethene
EPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

E.1: INTRODUCTION

This National Environmental Policy Act of 1969 (NEPA) Values Assessment accompanies the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) remedial documentation for Operable Unit 2 (OU-2) at the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL). The NASA JPL is located near Pasadena, CA. The Council on Environmental Quality (CEQ) and the Department of Justice (DOJ) have advised that federal agencies should integrate NEPA values into the CERCLA process when feasible and appropriate (DOJ, 1995).

E..1.1 Background

JPL is located within the city boundaries of La Cañada Flintridge, California; however it has a Pasadena mailing address. JPL comprises about 176 acres of land and more than 150 buildings and other structures. Most of the northern half of JPL is not developed because of steeply sloping terrain. The main developed area is the southern half of the site. The northeastern part of JPL is currently used for project support, testing, and storage. The southwestern part is used mostly for administrative, management, laboratory, and project functions.

JPL is a NASA-owned facility where the California Institute of Technology (CalTech) performs research and development projects. JPL also serves as the federal government's lead center for research and development related to robotic exploration of the solar system. In addition to work for NASA, tasks are conducted at JPL for other federal agencies in areas such as remote sensing, astrophysics, and planetary science.

During execution of past projects, various chemicals (including laboratory chemicals, solvents, solid and liquid rocket propellants, and cooling tower chemicals) and other materials were used at JPL. During the 1940s and 1950s, many buildings maintained "seepage pits," which are subsurface areas used to dispose of liquid and solid sanitary wastes collected from drains and sinks within the buildings. Some of the seepage pits may have received volatile organic compounds (VOCs) and other waste materials that currently are found in vadose zone soil and groundwater at JPL. In the late 1950s and early 1960s, a sewer system was installed at JPL, and the use of seepage pits for waste disposal was discontinued.

In 1980, VOCs were detected in groundwater from City of Pasadena water-supply wells located in the Arroyo Seco, near JPL. At about the same time, VOCs also were detected in two water-supply wells at the Lincoln Avenue Water Company, located downgradient of JPL. Subsequently, site investigations were conducted at JPL (Ebasco, 1990a and 1990b) and VOCs were detected in on-facility groundwater at levels above drinking water standards. In 1992, JPL was placed on the U.S. Environmental Protection Agency's (EPA's) National Priorities List (NPL) of CERCLA sites (47189-47187 *Federal Register*, 1992, Vol. 57, No. 199).

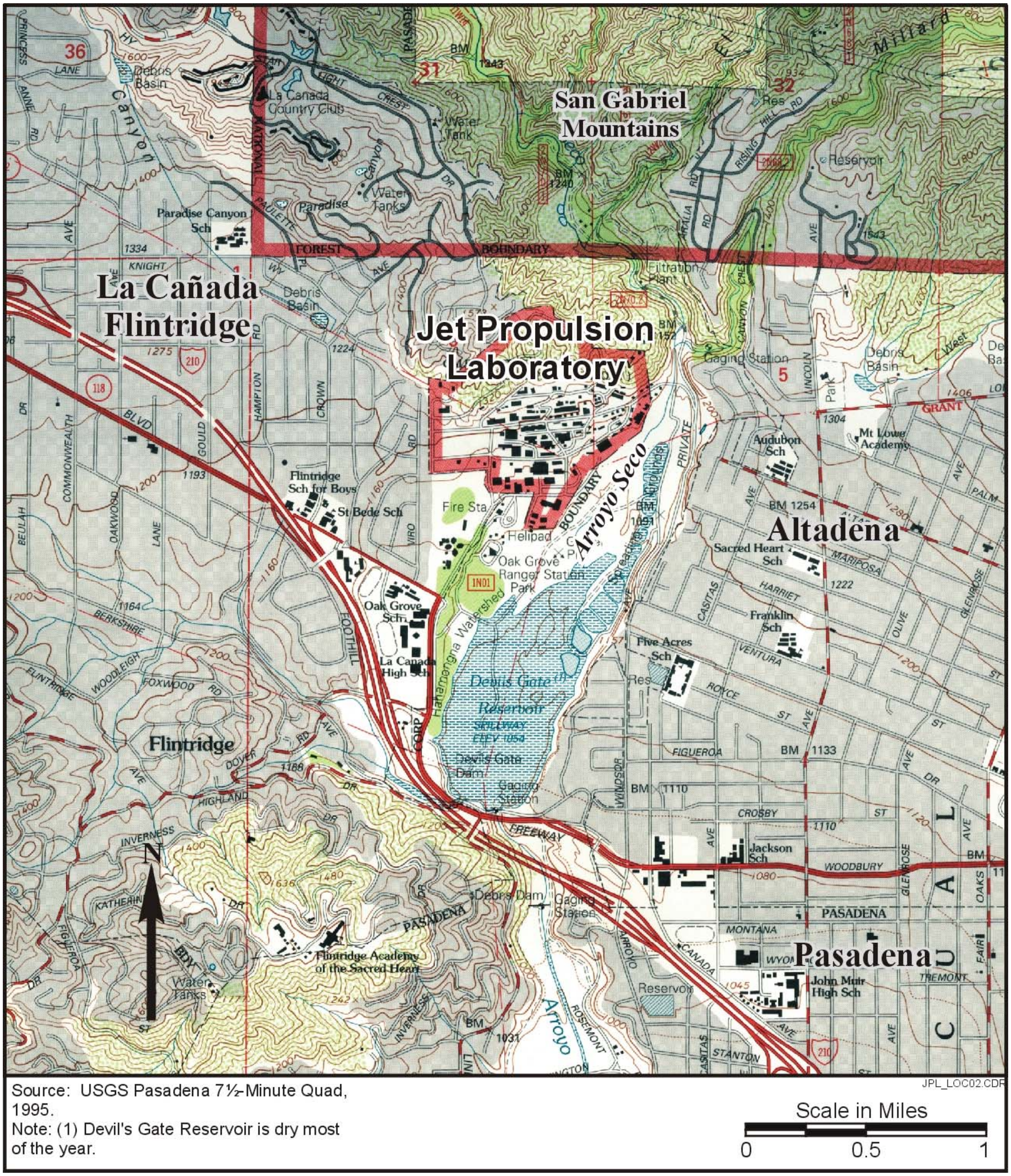


Figure E-1. Map of JPL and Surrounding Area

After being placed on the NPL, potential source areas were investigated from 1994 to 1998 during the Remedial Investigation (RI) phase, which included nine sampling events. The RI phase was followed by the Feasibility Study (FS) phase, which involved risk evaluation, data interpretation, and evaluation of an ongoing soil vapor extraction (SVE) pilot test.

The operable unit addressed in this NEPA Values Assessment, OU-2, is the second of three operable units at JPL. OU-2 consists of all on-facility vadose zone soil at JPL. The first operable unit, OU-1, encompasses all on-facility groundwater. The third operable unit, OU-3, consists of all off-facility groundwater adjacent to JPL. OU-1 and OU-3 will be addressed separately from OU-2, and not in this NEPA Values Assessment.

E.1.2 Purpose and Need

Under CERCLA, NASA must determine the appropriate action to remediate VOCs in vadose zone soil at JPL. This document accompanies CERCLA documentation for OU-2 and serves to integrate NEPA values into the CERCLA process for the remedial action.

E.1.3 Applicable Statutes and Regulations

This section discusses the federal, state, and local environmental statutes and regulations that are applicable or relevant and appropriate requirements (ARARs) to the remedial action at OU-2. A complete discussion of ARARs can be found in Appendix F of this Record of Decision (ROD).

E.1.3.1 National Environmental Policy Act of 1969, as Amended

This document is prepared in compliance with NEPA, as amended, and the Council on Environmental Quality Regulations for Implementing NEPA (40 CFR Parts 1500-1508). It is prepared to comply with NEPA through the assessment of selected NEPA values associated with the remediation of OU-2 at JPL.

E.1.3.2 Other Federal Regulations

A Federal Facilities Agreement (FFA) under CERCLA Section 120 was executed in 1992 by NASA, EPA Region IX, State of California, Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC), and the Regional Water Quality Control Board (RWQCB), Los Angeles Region (EPA, 1992). The FFA lists JPL as a Resource Conservation and Recovery Act (RCRA)/CERCLA site requiring further evaluation using an investigation/assessment process that integrates and combines the RCRA Facility Investigation Process with the CERCLA RI process to determine the actual or potential impacts.

Federal environmental regulations considered to be ARARs were identified as part of the CERCLA process. These ARARs will be used to establish standards, consistent with the National Oil Hazardous Substance and Pollution Contingency Plan (NCP), for any remedial actions at OU-2, unless waived. Appendix F of this ROD provides a summary of all identified federal ARARs and the impacts that those requirements will have on the design and administration of the JPL OU-2 remediation activities.

E.1.3.3 State and Local Regulations

State and local environmental regulations that are considered ARARs have been identified and will be used to establish standards that are consistent with the NCP for any remedial actions at JPL OU-2, unless waived. Appendix F of this ROD provides a summary of all identified state ARARs and the impact that those requirements will have on the design and administration of the JPL OU-2 remediation activities.

E.2: PROPOSED ACTION AND ALTERNATIVES

During the RI of OU-2, the following four VOCs were detected frequently at elevated concentrations in soil vapor samples: carbon tetrachloride (CCl_4); 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113); tricholorethene (TCE); and 1,1-dichloroethene (DCE). These compounds generally were located beneath the north-central part of JPL, and were detected in soil vapor at depths extending to the water table, which ranges up to 200 ft or more below ground surface (bgs). The *Final Remedial Investigation Report for Operable Unit 2: Potential On-Site Contaminant Source Areas* (Foster Wheeler Environmental Corporation [FWEC], 1999) and the *Final Feasibility Study Report for Operable Unit 2: Potential On-Site Contaminant Source Areas* (FWEC, 2000) contain detailed information and data for all of the environmental media samples taken in the characterization of OU-2.

Based on the evaluation performed as part of the FS, the selected alternative for OU-2 remediation involves installation of an SVE system. SVE is the most widely used technology at CERCLA NPL sites and has been identified by the EPA as a presumptive remedy for remediation of VOC-impacted soil. Presumptive remedy status is granted to technologies with proven effectiveness, eliminating the requirement to evaluate competing technologies. SVE systems are designed to remove VOCs by applying a vacuum through a network of underground wells. The soil vapor extracted from the subsurface is then treated to remove VOCs before discharge to the atmosphere. The proposed system for OU-2 will consist of up to five vapor extraction wells and vapor treatment systems. The actual number of wells will depend on the results of the soil vapor monitoring program and an ongoing SVE pilot test. VOCs in the extracted soil vapor will be treated in accordance with the South Coast Air Quality Management District (SCAQMD) requirements. The SVE system will be operated until the performance objectives are achieved (see Section 11.4 of the ROD).

A soil vapor monitoring program, currently in place, will be used to track VOC concentrations and areal extent of VOCs in the vadose zone over time. The monitoring program will consist of the periodic collection and analysis of soil vapor samples from existing soil vapor monitoring point network. This program will be used to evaluate SVE system effectiveness and progress toward achieving the remedial action objective (RAO). The RAO for OU-2 is to prevent, to the extent practicable, further migration of VOCs at potential levels of concern from the vadose zone to groundwater to protect an existing drinking water source. The soil vapor monitoring program will be terminated upon achieving the RAO.

NASA expects that the selected alternative, SVE, will satisfy the statutory requirements in CERCLA section 121(b) that the selected alternative:

- Be protective of human health and the environment
- Comply with ARARs
- Be cost-effective

- Use permanent solutions and alternative treatment technologies to the maximum extent practicable

- Satisfy the statutory preference for treatment as a principal element, or justify not meeting the preference.

Because SVE is an EPA presumptive remedy, the only other alternative considered for OU-2 was "no further action" (NFA). This alternative includes the soil vapor monitoring program described above as part of the selected alternative, but no treatment technologies to remediate VOCs in vadose zone soil.

E.3: AFFECTED ENVIRONMENT

The JPL site is located within the San Gabriel Valley, in the eastern part of Los Angeles County. It is located between the city of La Cañada Flintridge and the unincorporated city of Altadena, CA, northeast of the 210 Foothill Freeway near Pasadena, CA. Figure E-1 is a map of JPL and the surrounding area.

JPL is situated on a south-facing slope along the base of the southern edge of the east-west trending San Gabriel Mountains at the northern edge of the metropolitan Los Angeles area. The Arroyo Seco, an intermittent streambed, lies immediately to the east and southeast of JPL. Within the Arroyo Seco is a series of surface impoundments used as surface water collection and spreading basins for groundwater recharge. Residential development, an equestrian club (Flintridge Riding Club), and a Los Angeles County Fire Department Station (Fire Camp #2) border the JPL along its southwestern and western boundaries. Residential development also is present to the east of JPL, along the eastern edge of the Arroyo Seco.

E.3.1 Land Use

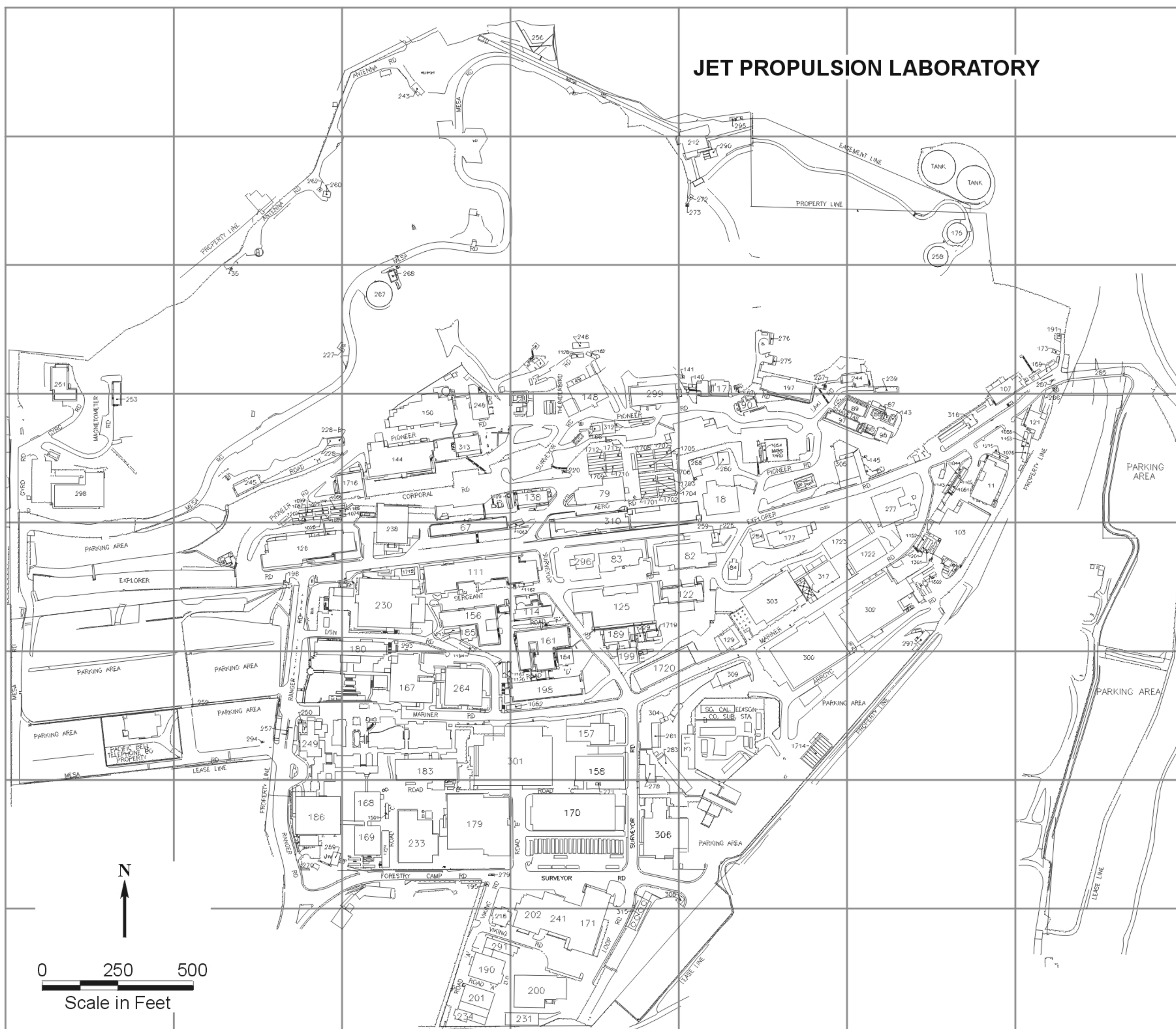
JPL comprises about 176 acres of land. Of these 176 acres, about 156 acres are federally owned. The remaining land is leased for parking from the City of Pasadena and the Flintridge Riding Club. The main developed area of JPL is the southern half, which can be divided into two general areas, the northeastern early-developed area and the southwestern later-developed area. Most of the northern half of JPL is not developed because of steeply sloping terrain.

Currently, the northeastern early-developed part of JPL is used for project support, testing, and storage. The southwestern later-developed part is used mostly for administrative, management, laboratory, and project functions. Further development of JPL is constrained because of steeply sloping terrain to the north, the Arroyo Seco to the south and east, and residential development to the west.

Located at the northern boundary of JPL is the Gould Mesa area. This area has widely separated, small buildings and is used primarily for antenna testing. The distance between buildings is a result of the terrain and the need to isolate transmitting and receiving equipment. The relatively steep mountainside between Gould Mesa and the developed area at JPL is unpopulated.

Presently, more than 150 structures and buildings occupy JPL. Total usable building space is approximately 1,330,000 ft^2. Figure E-2 is a facility map for JPL.

The primary land use in the areas surrounding JPL is residential and light commercial. Industrial areas, such as manufacturing, processing, and packaging, are limited. The closest residential properties are those located along the western fence line of JPL. The nearest off-facility buildings are the Flintridge Riding Club and Fire Camp #2, both located approximately 100 yards from the southern border of JPL. The total number of buildings within two miles of JPL is about 2,500, primarily residential and community (e.g., schools, day-care centers, churches).



Facility Locations

No.	Facility Title	Location
	Mars Yard	4-E
11	Space Sciences Laboratory	4-F
18	Structural Test Laboratory	4-E
35	Radio/Repeater Complex	3-B
67	Material Research	5-C
79	Wind Tunnel (20 inch)	4-D
82	High Vacuum Laboratory	5-E
83	Quality Assurance	5-D
84	Chemical Materials Laboratory	5-E
86	Solid Oxidizer Laboratory	4-F
87	Propellant Conditioning Laboratory	4-F
88	Mixing Laboratory	4-F
89	Laser Laboratory	4-F
90	Pyrotechnics Laboratory	4-E
97	Development Laboratory and Offices	4-E
98	Solid Fuel Laboratory	4-F
103	Fabrication Shop	5-F
107	Laser Research Laboratory	3-F
111	Technical Information	5-C
114	Electronics Development	5-D
117	Liquid and Solid Propellant Laboratory	3-E
121	Analytical Instruments Laboratory	3-G
122	Energy Conservation Systems	5-E
125	Combined Engineering Support	5-D
126	Information Systems Development	5-B
129	Combustion Research Laboratory	5-E
138	Mission Operations	4-D
140	Propulsion Materials Storage	3-E
141	Propulsion Materials Storage	3-E
143	Solid Rocket Dock	4-F
144	Environmental Laboratory	4-C
145	Magazine - Propellant	4-F
148	Energy Conservation Laboratory	4-D
149	Energy Conservation Development	3-D
150	25-Foot Space Simulator	4-C
156	Computer Program Offices	5-C
157	Applied Mechanics	6-D
158	Material Research Processing Laboratory	6-D
159	Pump House (water)	3-G
161	Telecommunications Laboratory	5-D
166	Cooling Tower	4-D
167	Cafeteria	6-C
168	Instrument System Laboratory	7-C
169	Earth Space Science	7-C
170	Fabrication Shop	7-D
171	Material Services	8-D
173	Test Shelter	3-G
175	Water Reservoir	2-F
177	Transportation Garage	5-E
179	Spacecraft Assembly Facility	7-C
180	Administration	5-C
183	Physical Science Laboratory	6-C
184	Electronic Stores	6-D
185	Programming Office	5-C
186	Science Exhibits and Engineering	7-B
189	Electronics Laboratory Annex	5-D
190	Procurement Offices	8-C
191	Materials Compatability Laboratory	3-G
195	Guard Shelter	7-C
196	Guard Shelter	5-B
197	Solid Propellant Engineering Laboratory	3-E
198	Control Systems Laboratory	6-D
199	Celestial Simulator	6-D
200	Facilities Engineering and Services	8-D
201	Carpenter Shop	8-C
202	Procurement and Communications Support	8-D
212	Antenna Laboratory	2-E
218	Credit Union	8-C
220	ICS Terminal	4-D
224	Sewage Lift Station	8-C
225	Nitrogen Facility Office	5-E
226	Solvent Storage	5-D
227	Pistol Range Storage	3-B
228	Cooling Tower (A-B)	4-B
229	Shielded Room Building	5-D
230	Space Flight Operation Facility	5-C
231	Paint Shop	8-D
233	System Development	7-C
234	Lumber Storage	8-C
237	Cooling Tower	3-E
238	Telecommunications	5-C
239	Propellant Conditioning Laboratory	3-F
241	Receiving and Shipping	8-D
243	Remote Antenna Range Control	1-C
244	Chemical Engineering	3-F
245	Spectroscopy Laboratory	4-B
246	Soils Test Laboratory	3-D
248	10-Foot Space Simulator	4-C
249	Visitor Reception	6-B
250	Main Guard Shelter	6-B
251	Gyro Laboratory	3-A
252	Guard Shelter	6-B
253	Magnetic Laboratory	3-A
256	Model Range Control	1-D
257	Main Guard Island	6-B
258	Water Reservoir	2-F
259	Liquid Nitrogen Bottling Storage	5-E
260	Illuminator Equipment	2-B
261	Controlled Storage	6-D
262	Radiometer	2-B

Trailer Locations

Trlr.No.	Location
1021	4-B
1025	7-C
1028	4-B
1033	7-D
1044	4-G
1054	4-E
1057	7-D
1058	4-F
1060	7-D
1063	5-D
1065	7-C
1069	7-D
1073	7-D
1074	4-B
1076	4-G
1079	7-C
1081	4-F
1082	6-D
1085	7-C
1086	4-B
1087	4-B
1088	7-D
1089	4-B
1099	4-B
1102	4-F
1109	7-C
1110	7-C
1114	7-C
1128	3-D
1129	4-C
1132	7-D
1140	7-D
1141	7-D
1143	4-F
1147	7-D
1150	7-C
1151	7-D
1152	5-F
1153	4-G
1154	7-D
1155	7-C
1156	7-C
1162	5-D
1166	7-C
1167	6-C
1168	4-B
1169	7-D
1170	6-C
1173	7-C
1177	7-D
1180	7-D
1182	3-D
1186	7-D
1194	5-C
1197	7-D
1200	7-D
1201	5-F
1202	4-B
1203	7-D
1208	7-C
1213	5-C
1215	4-F
1300	7-D
1301	5-F
1304	7-D
1306	7-D
1307	7-D
1501	7-C
1502	5-F
1701	4-D
1702	4-D
1703	4-D
1704	4-D
1705	4-D
1706	4-D
1707	4-D
1708	4-D
1709	4-D
1710	4-D
1711	4-D
1712	4-D

No.	Facility Title	Location
264	Space Flight Support	6-C
267	Water Reservoir	3-C
268	Pump House	3-C
270	Sewage Metering Station	7-B
271	Oil Storage	6-D
272	East Illuminator	2-E
273	Antenna Tower	2-E
275	Pyrotechnic Storage	3-E
276	Propellant Storage	3-E
277	Isotope Thermoelec. Sys. Appl. Lab.	4-F
278	Robotics Laboratory	6-D
279	Guard Island	7-C
280	Static Test Tower	4-E
283	Metal Storage	6-D
284	Transportation Office	5-E
285	Arroyo Bridge	3-G
286	Guard Shelter	3-G
287	Guard Island	3-G
288	Project Equipment Storage	4-E
289	Main Sewage Lift Station	7-B
290	Antenna Inspection	2-E
291	Procurement Services	8-C
293	Instrumentation Cable Amplifier Building	6-C
294	Guard Shelter (Visitor Lot)	6-B
295	Antenna Test Facility	1-E
296	Central Cooling Tower Water System	5-D
297	Xenon Test Laboratory	5-F
298	Frequency Standard Laboratory	4-A
299	Assembly Handling & Shpg. Equip. Fac.	4-D
300	Earth and Space Science Laboratory	5-E
301	Central Engineering Building	6-D
302	Microdevices Laboratory	5-F
303	Engineering Support Building	5-E
304	Disintegrator	6-D
305	Hazardous Waste/Cryogenic Storage Facility	4-E
306	Observational Instruments Laboratory	7-D
308	Sewage Lift Station	7-E
309	Maintenance Storage Facility	6-E
310	X X X	4-D
311	Ground Maintenance Facility	6-E
312	Shelter Maintenance Facility	4-D
313	Mirror Refurbishment	4-C
315	X X	8-D
316	Hazmat Storage and Dist Facility	4-F
317	In-situ Instruments Laboratory	5-E

MODULARS:

1701-1712	Modular Offices	4-D
1714	Modular Offices	6-E
1716	Modular Offices	4-C
1718	Modular Offices	5-C
1719	Modular Offices	5-D
1720	Modular Offices	6-D

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Figure E-2. Facility Map of JPL

E.3.2 Regional Demographics

Based on the United States Census 2000, the total population residing within 1 mile of JPL is 9,500 people. The population residing within 2 miles of JPL is 22,500 people, and the population residing within 3 miles is 44,000.

In 2001, the JPL workforce consisted of approximately 5,175 employees and contractors. Major sources of employment in the area surrounding JPL are office, retail, and service centers, primarily located within Pasadena. Residents of Altadena and La Cañada Flintridge generally are employed outside their home community, except those conducting retail businesses or professional services for their respective communities.

In 2000, the population of Pasadena was approximately 133,936 and was broken down into the following demographics: 71,469 Caucasian; 19,319 Black or African-American; 952 American Indian; 13,399 Asian; 132 Pacific Islander; and 28,665 multiracial or other racial group.

In 2000, the population of Altadena was approximately 42,610 and was broken into the following demographics: 20,156 Caucasian; 13,388 Black or African-American; 247 American Indian; 1,807 Asian; 56 Pacific Islander; and 6,956 multiracial or other racial group. The population of La Cañada Flintridge in 2000 was approximately 20,318 and was broken into the following demographics: 15,142 Caucasian; 73 Black or African American; 36 American Indian; 4,180 Asian; 9 Pacific Islander; and 878 multiracial or other racial group.

According to the United States Census 2000, 33.4% of the Pasadena population identifies their ethnic group as Hispanic, while 20.4% of Altadena residents and 4.8% La Cañada Flintridge residents identify themselves as Hispanic.

E.3.3 Meteorology and Climatology

The San Gabriel Valley has a semiarid Mediterranean climate characterized by mild, rainy winters and warm, dry summers. Rainfall in the area is variable, although it typically averages about 15 inches per year overall (Boyle Engineering, 1988). Rainfall in the vicinity of JPL is slightly higher than for the City of Los Angeles, averaging about 20 inches per year. The higher amount of rainfall near JPL results from the orographic effects generated along the southern slope of the San Gabriel Mountains. Roughly 80% of the precipitation occurs between the months of November and April.

Temperatures in the San Gabriel Valley are relatively mild, with August typically being the warmest month and January the coolest. Extremes for the area range from about 30^{o}F in January to 105^{o}F during the summer months. Wind patterns change seasonally in both strength and direction in response to normal seasonal variations in barometric pressure systems. Generally, winds are mild throughout the year, characterized by ocean breezes (onshore) during the day and land breezes (offshore) at night.

Occasionally during the fall, the area is affected by the Santa Ana winds. These winds occur as a result of strong high-pressure systems moving into parts of Nevada and Utah, creating strong, hot, dry winds from the northeast. Santa Ana wind speeds through Arroyo Seco have reached more than 100 miles per hour.

E.3.4 Geology and Seismology

This section discusses the geology and seismology of the area surrounding JPL. Figure E-3 is a map of the regional geology and physiography. Figure E-4 is a geologic map of JPL and the surrounding area.

JPL is located immediately south of the southwestern edge of the San Gabriel Mountains (see Figure E-3). The San Gabriel Mountains, together with the San Bernadino Mountains to the east and the Santa Monica Mountains to the west, make up a major part of the east-west trending Transverse Ranges province of California. This province is dominated by north-south compressional deformation.

The San Gabriel Mountains are primarily composed of crystalline basement rocks. These rocks range in age from Precambrian to Tertiary and include various types of diorites, granites, monzonites, and granodiorites with a complex history of intrusion and metamorphism (Dibblee, 1982). The northwest part of the San Gabriel Valley, near JPL, is composed of about 1,500 to 2,000 ft of Cenozoic alluvial-fan deposits that unconformably overlie the crystalline basement complex exposed in the San Gabriel Mountains (Smith, 1986). These alluvial deposits typically consist of poorly sorted, coarse-grained sands and gravels, with some finer sand and silty material. Clasts within the alluvial deposits range from silt size to boulders more than 3 ft in diameter.

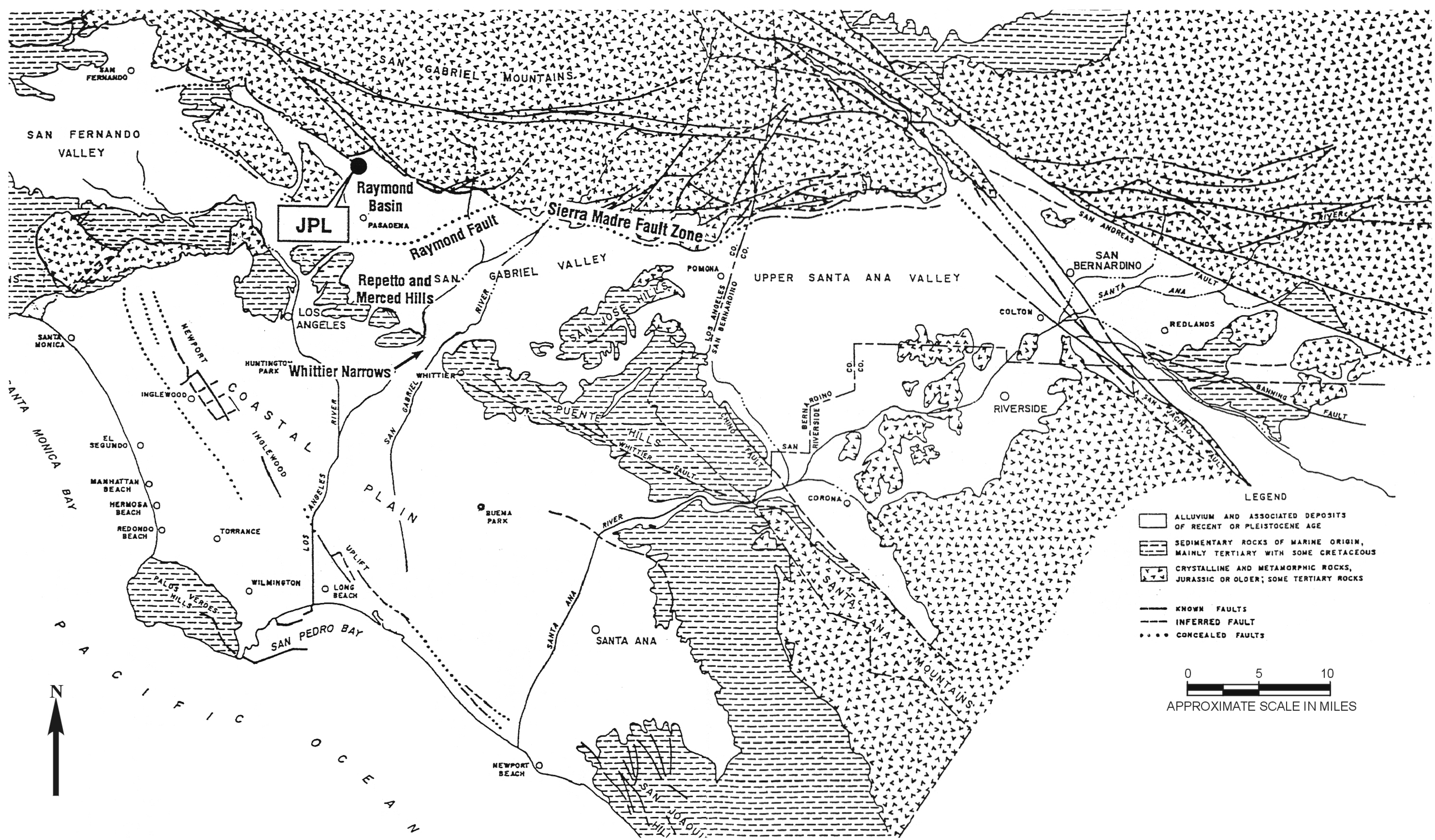
Periodic tectonic uplift of the San Gabriel Mountains has occurred during the past 1 to 2 million years. This uplift is responsible for the present topography of the area (Smith, 1986). Most of this uplift has occurred along north- to northeast-dipping reverse and thrust faults located along the south to southwest edges of the San Gabriel Mountains. This system of faults along the southern edge of the San Gabriel Mountains is the Sierra Madre Fault system. The Sierra Madre Fault system separates the San Gabriel Mountains to the north from the San Gabriel Valley to the south.

E.3.5 Hydrology

This section discusses the hydrology of JPL and the surrounding area. JPL is located in the northwest part of the Raymond Basin watershed (see Figure E-3).

E.3.5.1 Surface Water

There are no permanent surface water bodies within the boundaries of JPL. The northernmost part of JPL consists of Gould Mesa, a flat-topped southern promontory of the San Gabriel Mountains that rises 300 ft above the main part of the JPL complex. The remainder of JPL is moderately sloped and has been graded extensively throughout its development. The Arroyo Seco Creek intermittently flows through the Arroyo Seco wash on the east side of JPL. Within the Arroyo Seco, a series of surface impoundments are used as surface water collection and spreading basins for groundwater recharge.



SOURCE: CALIFORNIA WATER RESOURCES BULL NO. 104. PLANNED UTILIZATION OF THE GROUND WATER BASINS OF THE COASTAL PLAIN OF L.A. COUNTY, 1961.

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Figure E-3. Map of Regional Geology and Physiography